EXHIBIT 104
REDACTED

Background

This document captures discussion between gTrade team (████████ nirmaljayaram, █████ and GDN Auction team (██████████ on issues related to incentives, efficiency, etc. See Auction page for more background on auction team mission.

Key Question this Document Should Answer

What are the constraints that GDN must operate under when acting as a bidder on third party exchanges (AdX, AWBID, etc).

First, and most importantly, **we do not change AdX or AWBID auction mechanisms**. The SSP sets up the auction according to however the publishers wish to monetize their inventory, with appropriate rules (first price vs second price, dynamic floors, etc.)

What are the additional *necessary* constraints?
TBD

What are the v1 launch constraints?
For Bernanke v1 launch (Oct 2013) gTrade agreed to be a "good citizen" and not simply optimize for GDN profit. Rather, the agreed upon constraints from discussions with AdX team, ██████████, GDN leads were:
- Do not change eCPM calculation, e.g. to account for uncertainty in pCTR
- Do not change how advertisers are charged
  - GDN charges advertiser based on max of AdX clearing price and the CAT2 second price, capped at max first price
  - min(CAT2 first bid, max(CAT2 second bid, AdX clearing price / 0.86)
- Keep GDN buy-side margin to 14% per sub-WebProp, averaged over e.g. 1 week
- Do not apply bid increases / DRS to budget-constrained impressions
- Keep number of first priced queries on AdX to less than 10% of all queries across GDN + AdX.
- Smoothly rollout Bernanke x%/wk to limit visible impact to AdX buyers and publishers.

Discussion

Q: What exactly is auction team concern?

A: Adhere to principles outlined in Auction page

(████ Just because another network/exchange is doing something doesn't mean that we should do it too.
If we choose not to maximize efficiency, then we must be less competitive for advertisers, publishers, or both relative to maximizing efficiency, so it would create a competitive disadvantage.

In the long run, having a system that creates the most value will bring more advertisers and increase publisher revenue.

Although we believe efficiency is a good goal, we have talked about ways of trading off revenue for efficiency. However, it's hard to increase revenue without giving up even more efficiency.

(████████ Efficiency is the value the winning advertiser had for all queries... even if that quantity is not measurable by us.

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(████████ Essentially, I am very worried that by forcing advertisers to deviate from their current bidding strategy, Bernanke is going to do a few bad long-term things:

- ██ because advertisers will now adjust their bidding strategy to compensate for any changes that reverberate w/ second order Bernanke effects.
- Given that our current auction design encourage advertisers to *maximize* their bids across all auctions, the adjustments to bids will have to be a net reduction in bids.
- These reductions in bids will impact future allocation efficiency.
- The non-uniform reduction in bids across advertisers means that we'll be even less capable of measuring efficiency than we are today, driving us further from one of our collective goals.

Q: Can you translate the above statements on efficiency into concrete goals/constraints for our system? Please give a crisp definition of efficiency and how to measure it in this context of exchange bidding.

A: TBD ████████

Q: Discuss the gTrade incentive problem:

A: (████ see this presentation (copied below).

Advertiser bid = $1.50 (pre-revshare)
Adx threshold = $1

post-revshare bid = $1.50 * 0.86 = $1.29 -> advertiser wins, pays $1 (converted back to $1.163 pre-revshare)

If advertiser lowers bid, nothing changes until they hit $1.163. Below that, they lose.

Now, if advertiser drops bid below $1.163, they still win AND they pay less:
Advertiser bid = $1.10 (pre-revshare)
Adx threshold = $1

Now we adjust revshare to be 0.909
post-revshare bid = $1.10 * 0.909 = $1

Advertiser wins and pays $1.10. If they lower bid even further, they'll win and pay their bid, all the way down to $1. This is because we are doing first pricing throughout the range of dynamic revshare.

This happens with negative revshare too:
Advertiser bid = $0.9 (pre-revshare)
Adx threshold = $1

Now we adjust revshare to be 1.111 (again, to hit $1 post-revshare)

Advertiser wins and pays $0.9 (first pricing). If they lower the bid even further, they'll win and pay their bid (up to whatever limit we place on how much we're willing to overpay). This subsidy comes from all the other advertisers paying the cat2 second price, so this advertiser is just grabbing free money.

- Bernanke takes money from from queries where cat2 sets the second price and uses it on queries where we'd otherwise lose
- Advertisers on the first set of queries are net payers, paying to subsidize those the net takers in the second set
- Advertisers can become net takers by lowering their bids.
- As some advertisers lower bids, other advertisers have more room to lower their bids.
- Lower bids also result in less money in the second pricing subsidy pool

(Response from ▇▇▇ about bid lowering)
▇▇

While I agree you make a perfectly valid point (an advertiser can in theory win *THE* query where we applied DRS/Bernanke) at a lower bid, I would postulate:

1) They don't know *WHICH* random set of queries we are "subsidizing", hence lowering their bid will hurt volume on all the other queries (e.g. adsense, other adx queries where Bernanke not active). We currently limit any advertiser to being "subsidized" (margin < 14%) to at most 10% of their total queries across the whole network. ▇▇

2) Related to #1, if they reduce bid < CAT2 second price they can't win. This sets a floor within our DSP (GDN).

3) We have not observed this bid reduction effect from DRS launch, because advertiser does not have a visibly flat price-volume relationship, and thus no motivating reason to reduce bids. Nirmal or Sunder should have data on this...

4) The effect of Bernanke will automatically reduce as any of these happen - a) GDN advertisers lower bids, b) publishers raise reserve prices or adx buyers increase bids. Why? Whenever we second price ourselves less, or are forced to pay more to win subsidized queries, the pool of money for Bernanke goes down. We are fine with this. The end goal is not to have any second bids at all, and then Bernanke is a no-op.

In any case, to quantitatively address these issues, we plan to holdback a set of advertisers where we won't perform any DRS/Bernanke first bid increases (██████ is leading this effort, please sync if interested in details). We can track the performance of such advertisers to see if they notice and/or respond to any incentive problems.

Q: (██████ Let me suggest this straw man proposal (and for simplicity, forget about adx for a second and just think about the cat2 auction): let's change our auction to first pricing, with all the same 10% throttling logic as gTrade uses. Clearly the short term effect is just that we make more money. And if advertisers try to lower their bids, they start losing some of the queries they were previously getting. Do you think this would be a good idea? If not, what is it about your argument that justifies Bernanke but not a complete first price auction?

A: (██████
Short answer to ████ and ██ as i am jumping on the plane: growing the pie that is the difference, what you said is a zero sum game but Bernanke is matching new queries. If AdX match rate grows to 100% without doing Bernanke, Bernanke stops automatically.

A: (██████
Bernanke is totally different than randomly charging the advertiser their first price on x% of queries that they were already winning. And definitely different than "let's do something sneaky to make more money and throttle it so nobody notices" :-)

Let's recap:

1) Bernanke does not change AdX auction or CAT2 auction rankings. ████████████████
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2) Bernanke does not change how advertisers are priced - it is the maximum of the CAT2 second price and AdX clearing price, capped at first price.
3) Bernanke does not change anything about queries the advertiser was already winning. They will continue to win all the same queries at exactly the same price. (This is the main difference from straw man).
4) What does change, is that there are some previously unmatched queries that GDN can not

win even at first price because the AdX reserve price is too high (or perhaps from competition from other DSPs). On a random set of such queries, we pay extra to the publisher and let the advertiser win. The advertiser's bid is less than the AdX clearing price, so we just charge the first price as outlined in #2.

5) Where does money in #4 come from? It comes from reducing second bids elsewhere. We could have kept the money, but decided to pay it back via #4, since this increases advertiser impression/click/conversion volume, increases publisher revenue, and keeps GDN margin constant.

6) We only perform Bernanke on budget unconstrained advertisers, thus total GDN revenue goes up.

7) Even though I don't think it's necessary, we enforce that any single adgroup can only have ██ of its queries subsidized via #4. This was the existing limit from DRS launch. Bernanke v2 would spend the money on the queries we think are most important/profitable/good ROI for advertiser, etc. For instance, if the new queries in #4 have great ROI, why wouldn't we buy more of them for the advertiser?

The main argument that kicked off this thread is it's "wrong" to subsidize a query because then the advertiser, if they could a-priori identify such queries (which they can't) could reduce bid on just those queries and still win them at lower price.

But this can't happen.

First, advertiser only has knob to reduce bid across the whole network, not query by query.

Second, even *if* the advertiser could reduce bid on exactly the queries where we must subsidize bid to win, they must keep the bid above the CAT2 second price to continue winning. Also, we'd be paying higher subsidy on each query (to meet the AdX clearing price). Thus we can't win as many queries before paying back the pool of money to the publisher. By reducing bid, the advertiser wins *less* queries, not the same number. The incentive goal of "you should never win the same number of queries for lower price" is maintained.

Q: We (gTrade) are not changing the AdX auction at all, nor the auctions that 3rd party exchanges setup on AWBID. The SSP should setup an auction that incentivizes good behavior from buyers (DSPs). Then DSPs can bid however they want to achieve their goals of profit and advertiser happiness. So fundamentally the discussion is about how to achieve advertiser happiness, yes?

A: TBD (██████

Q: Is it acceptable to decrease buy-side margin for different classes of advertiser?

A: (██████
YES - The auction team would have no objections with a proposal to lower margin on Remarketing to something close to 0. That would improve efficiency in the auction and not do